

Designation: D 1590 - 60 (Reapproved 1977)^{e2}

Standard Test Method for Surface Tension of Water¹

AMERICAN SOCIETY FOR TESTING AND MATERIALS
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^{e1} NOTE—Editorial changes were made in the title, throughout the text, and by adding two sections in July 1977.

^{e2} NOTE—1.3 was added editorially in February 1989.

1. Scope

1.1 This test method covers quantitative measurement of the surface tension of water and waste water. The test method is based on instrumental measurement by the ring method and offers the most precise and accurate determination.

1.2 This test method is not intended to show any direct relationship between surface tension and concentration of surface-active agents.

1.3 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

- 2.1 *ASTM Standards:*
- D 1066 Practice for Sampling Steam²
- D 1129 Definitions of Terms Relating to Water²
- D 1192 Specification for Equipment for Sampling Water and Steam²
- D 1193 Specification for Reagent Water²
- D 3370 Practices for Sampling Water²
- E 380 Metric Practice³

3. Summary of Test Method

3.1 The test method is based on measurement of the force required to detach a ring from the surface of the sample.

4. Definitions

4.1 The term *surface tension* in this test method is defined in accordance with Definitions D 1129 as follows:

4.1.1 *surface tension*—a property arising from molecular forces of the surface film of all liquids which tend to alter the contained volume of liquid into a form of minimum superficial area.

NOTE 1—Surface tension is numerically equal to the force acting normal to an imaginary line of unit length in a surface. It is also

numerically equal to the work required to enlarge the surface by unit area. The usual unit of measurement is dynes per centimetre.⁴

4.2 For definitions of other terms used in this test method, refer to Definitions D 1129. For an explanation of the metric system including units, symbols, and conversion factors, see Standard E 380.

5. Apparatus

5.1 *Tensiometer*⁵—A sensitive torsion balance provided with means for applying a slowly increasing force to a platinum-iridium ring in contact with the surface of the sample. The apparatus shall be provided with a graduated scale to give readings in dynes of force when properly calibrated.

5.2 *Ring*, accurately constructed of platinum-iridium wire. The ring shall be circular, in one plane, free of bends or irregularities. The circumference and ratio of diameter of the ring, R , to the diameter of the wire, r , shall be known to the third significant figure. The ring shall be suspended vertically from the instrument so that the plane of the ring is parallel to the surface of the sample being tested.

5.3 *Measurement Vessel*, no smaller than 60 mm in diameter, and such that the ring will be in a flat area of the sample surface and well removed from the meniscus effect near the edge of the container. A crystallizing dish having approximate dimensions of 60 by 35 mm has been found satisfactory.

5.4 *Centrifuge*—Heavy-duty type equipped with suitable head to carry four 100-mL capacity tubes and having a minimum operating speed of 1500 rpm.

6. Reagents

6.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.⁶ Other grades may be used, provided it is first ascertained that the

⁴ The surface tension of pure water is given in the International Critical Tables as 72.75 dynes/cm at 20°C.

⁵ Either the du Nouy precision tensiometer equipped with a 4-cm circumference ring or the du Nouy interfacial tensiometer with a 6-cm ring may be used for this purpose.

⁶ "Reagent Chemicals, American Chemical Society Specifications," Am. Chemical Soc., Washington, D.C. For suggestions on the testing of reagents not listed by the American Chemical Society, see "Reagent Chemicals and Standards," by Joseph Rosin, D. Van Nostrand Co., Inc., New York, N.Y., and the "United States Pharmacopeia."

¹ This test method is under the jurisdiction of ASTM Committee D-19 on Water and is the direct responsibility of Subcommittee D19.09 on Saline Water and Water for Subsurface Injection.

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² Annual Book of ASTM Standards, Vol 11.01.

³ Annual Book of ASTM Standards, Vol 14.02.